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SECTION II—CLAIMS

1.-38. (Canceled)

39. (New) An apparatus comprising a diffractive grating formed in a substrate, the diffractive grating comprising:

a plurality of sub-gratings, each sub-grating having a pair of lateral edges and a periodic array of diffraction elements, wherein the sub-gratings are positioned laterally adjacent to each other and wherein each sub-grating has an amplitude, a spatial phase shift, a spatial period, and an optical phase shift ($A_i, x_i, \Lambda_i, \varphi_i$, respectively), and wherein amplitude and phase parameters of each sub-grating are determined according to the equation

$$a_i = \beta d \int_{m/(\beta\Lambda_i)-1/(2\beta d)}^{m/(\beta\Lambda_i)+1/(2\beta d)} \frac{T(v)}{F_i(v)} \exp\left(-j\pi\left(v\beta - m/\Lambda_i\right)\left(x_i^a + x_i^b\right)\right) dv$$

wherein $T(v)$ is a complex-value spectral transfer function, j is the square root of -1, m is a diffraction order, v is a frequency of an input optical field, $F_i(v)$ is a spatial Fourier transform applied to the input optical field by an ith sub-grating, $\beta = (\sin\theta_{in} + \sin\theta_{out})/c$, wherein c is the vacuum speed of light and θ_{in} and θ_{out} are angles between a direction of propagation of the input optical field and an output optical field and a line normal to the sub-grating, respectively, x_i^a and x_i^b are edge coordinates of the ith sub-grating, d is a sub-grating width equal to $x_i^b - x_i^a$, A_i determines an amplitude of a_i, and x_i and φ_i determine a phase of a_i.

40. (New) The apparatus of claim 39 wherein the sub-gratings are positioned to apply a predetermined complex-valued spectral function to the input optical field.

41. (New) The apparatus of claim 40 wherein amplitudes of the sub-gratings control the predetermined complex-valued spectral transfer function.

42. (New) The apparatus of claim 41, further comprising an active device that dynamically reprograms each sub-grating to correspond to the predetermined complex-valued spectral transfer function.

43. (New) The apparatus of claim 39 wherein the sub-gratings have optical thicknesses, the optical thicknesses of each sub-grating being controlled by respective variations in thickness of the substrate.

44. (New) The apparatus of claim 39 wherein the sub-gratings are transmissive gratings.

45. (New) The apparatus of claim 39 wherein the sub-gratings are reflective gratings.

46. (New) The apparatus of claim 39 wherein the sub-gratings are positioned along a planar surface.

47. (New) The apparatus of claim 39 wherein the sub-gratings are positioned along a non-planar surface.